Towards the Development of Internet Tracker Mobile Application Based on User's Preferences

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Abstract

The COVID-19 pandemic has driven educational institutions worldwide to shift their mode of delivery online where internet connectivity plays a crucial role in the continuity of learning and sustainability of the student outcomes. With the Philippines having one of the slowest internet speeds in the world, it is not unusual for students and teachers to encounter problems concerning connectivity. The aim of this study is to produce a mobile application that would monitor internet connectivity and consumption. The target respondents of this study are students from different universities in the National Capital Region. Explanatory Case Study Design is used to determine how and why internet connectivity is slow, while Exploratory Case Study Design is used to answer who and what aspects and factors affect the internet connectivity. Input-Process-Output (IPO) Model is used to determine the questions to be asked to the respondents, on how the data would be analyzed, and the probable solution that would be proposed to answer the main problem of the study. The proponents had identified the different user requirements by incorporating Quality Function Deployment (QFD) in order to generate specific features that must be included on the mobile application to satisfy the user's needs and expectations.

Keywords
internet connectivity, online classes, mobile application, Input-Process-Output Model, Qualify Function Deployment

1. Introduction

Distance learning was widely introduced and adopted in the Philippines because of the COVID-19 pandemic. It is divided into two kinds of delivery: synchronous and asynchronous classes. Synchronous classes pertain to live online meetings of the class using various video communications, while the asynchronous classes are self-paced wherein videos and tasks are provided for the students to accomplish at a certain amount of time.

Based on the data of Commission on Higher Education (CHED), there are 3,408,815 college students enrolled for the academic year 2019-2020. These students are relying heavily on internet connectivity to attend to their school requirements. The Philippines being known for having the second slowest internet connection in Southeast Asia, these students usually experience interruption or access issues which in turn, affects their compliance to requirements and eventually their learning outcomes. Thus, there is a need for them to track and to gauge their internet connectivity in order to show sufficient proof to their respective educational institutions that they have been having difficulties, or even to help them decide if it is time to explore other internet service providers.

1.1 Objectives

The objective of this study is to help students provide sufficient proof that their internet connection was not stable during their online session so that the educational institution would reassess if it were possible to give them consideration in complying with their missed school requirements.

The specific objectives of this study concern the internet connectivity, students and their financial status, educational institutions, and internet service providers, discussed as follows:

- Determine the population of students who are struggling on their online classes due to weak internet connectivity.
- Determine what aspects mostly affect their weak internet connectivity, whether it's due to their local, internet consumption, and devices or individual connectivity.

2. Literature Review

2.1 Sentiment Analysis on Online Education

In the study conducted by Pastor (2020) in the Pangasinan State University, a survey was employed to see how many students are ready for synchronous online delivery during the pandemic. It also aims to see how responsive the students are into answering the questions in the survey. The results of the study revealed that most students have internet connection; this includes the non-paid internet subscription and the location of the student. Another result of the study showed that most of the students have negative sentiments about the synchronous delivery. Through the digital divide, it is shown that in the shift to online classes during the pandemic, it has gotten worse – many teachers are not ICT literate, lack internet connections and have incomplete ICT facilities in the public schools. It is also revealed that students who do not have access to the internet lack the access to education. Many students are left out of the digital loop and many people lack devices to use for learning online. It suggests that the government should invest more on ICT education and infrastructure.

2.2 Internet Speed

The study about internet speed conducted by Kim and Salac (2016) aims to evaluate the cause of the slow internet connection and the high cost that people pay for it in the Philippines. It shows that the poor quality of service provided by the ISP is shown by the lack of competition. It also explains how the government can fix the issues. PLDT is considered as the largest and fastest internet service provider used in the entire country.

In the average speed connection speed, the Philippines is one of having the slowest connection speeds in the world. It also shows the high paying price to pay for an internet service compared to the rest of the world. It is blamed due to the lack of competition in the ISP market. The suggestion here is the introduction of another player in the ISP market. The cost of internet connection will be reduced due to the competitive market.

2.3 Internet Accessibility

With the introduction of online classes, there are barriers that are perceived by both the students and the teachers. Marcial et al (2015) explains that there is a need to invest in internet infrastructure and bandwidth. According to one of the results of the study, the greatest barrier perceived by the respondents is the cost and access to internet. The respondents also face technical issues when using online learning tools. The teachers must be aware of the use of online learning in high education institutions and should be able to take advantage of many online classes that are offered online.

2.4 Data Privacy and Collection

In a study regarding privacy (Harari, 2020), the individual who owns the device is permitted to exercise their privacy on how their data is collected. It is important that there is a transparency in the tracking process in a way where it is explained on how their data is used, collected and processed. It lets the individuals have a sense of control regarding their privacy and let them have control over their personal data.

2.5 Issues Regarding Online Education Delivery

In the study of Adnan (2019) the students who were undergraduates and the students who were taking up master's degree took a survey regarding their perception of the online deliberation of teaching in Pakistan. The result of the study showed that their expected results cannot be achieved since majority of the students were unable to have access to the internet connection due to technical issues and monetary issues. The problem regarding the response time between the teacher, their classmates, and the missing presence of interaction with them that happens inside the traditional classroom were raised. This study can help the researchers in proving that the online deliberation of the class in most of the universities, and schools in the country are not yet ready to fully implement the synchronous online education that is the ideal to implement during a pandemic.

3. Methods

The first step in the process of the study's research framework is input action, where the respective respondents will provide the necessary information that will answer the proponent's queries. The second step is the process action where the questionnaire will be assessed by the proponents to validate if the respondents had provided the required data. Then after the assessment process, the collected data will be deployed on presentation and data analysis to review and recompute the different accumulated percentage and values. The interpretation of data is the stage where the proponents will come up with a specific solution and determine what major factors that had caused weak internet connectivity. Last step would be the Output action where the collated information from the previous steps will then be applied to create a mobile design that would monitor the consumption and state of their internet connectivity.
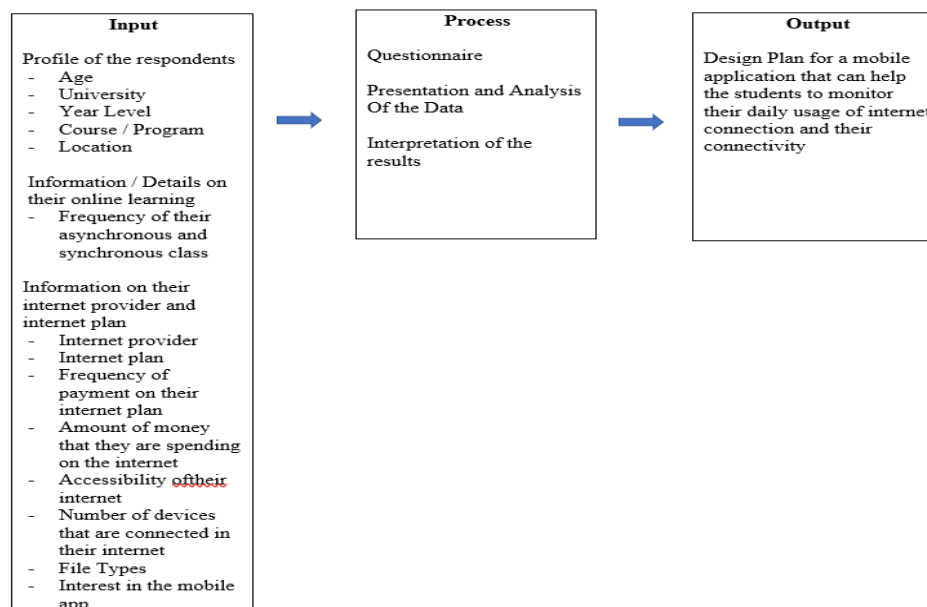

Figure 1. Research Framework

4. Data Collection

4.1 Data Gathering

The population of interest for this study were the college students of National Capital Region (NCR). Since their population was large for the researchers to handle, the researchers used the formula for very large populations wherein the population parameters were not available and the variables such as margin of error, confidence interval and standard of deviation were set by the researchers themselves. The researchers set the margin of error to 10%, the confidence level to 99% with an equivalent of 2.58 in z-score and an alpha value of 0.01, while the standard of deviation was set to 0.5 resulting to the sample size of 167.

The researchers decided to gather data using the snowball technique because they will be asking help from their acquaintances from the involved universities to spread the google survey forms among the college students. The research instrument that the researchers used was an online survey which was made by the researchers. To ensure its reliability, the researchers conducted a trial survey using this survey form for a certain number of respondents.

The survey is composed of questions that would help the researchers in coming-up with the mobile application. The first half of the survey pertains to the demographical information of the respondents in order to identify the location of the respondents and their internet plan that would be used in describing the current situation of their set-ups in their corresponding locations. The second half of the survey tackles about their preference if they were asked to have a mobile application that would monitor their internet connection. It contains the frequency of notification, the type of message that they would get from the mobile and the updates that they want to receive if they have an application.

4.2 Data Analysis

The computational metric that was used by the researchers were the percentages and frequencies. Percentages and frequencies were used when there were two answers in a question and are being compared to each other. This method will be further clarified through the use of tables and charts in order to give a visual representation of the data. In analyzing the current situation of the study. The researchers also used the Quality Function Deployment (QFD) in the design phase of the mobile application. Quality Function Deployment is a kind of process and tool that will help the researchers in identifying the customer requirements and turn them into an actual design of the mobile application. It is composed of customer requirements, functional requirements, correlations between the functional requirements, relationship matrix between the customer and function requirements, and different features that will help in determining the right priority and right specifications in coming up with the mobile design.

4.3 Data Design

This study used a mixed design of Explanatory and Exploratory Case Study designs. These types of designs were utilized since the study aims to know how or why the students experienced a weak internet connectivity and to determine who or what are the different aspects and factors that affects their internet connectivity. To determine our target respondents, we had utilized snowball and random sampling technique and come up with 167 respondents by assigning a marginal error of 10%, a confidence level of 99% that equates to 2.58 in z-score and an alpha value of 0.01, and the standard of deviation was set to 0.5.

In analyzing the data gathered, the proponents used percentages and frequencies that provided two types of data which is the percentage of the certain number of students and the exact number of students from the total population. Another is the QFD or Quality Function Deployment that helped the proponents to identify requirements that should be included on the mobile application. In order for the proponents to analyze the data they've deployed survey-questionnaire as their research instrument in gathering such data, this help the proponents to measure which aspects majorly causing weak internet connection among the respondents. The setting of the research study occurred within metro manila universities only.

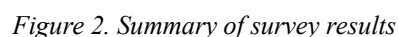## 5. Results and Discussion

5.1 Numerical Results

Table 1 depicts the Quality Function Deployment (QFD) showcasing the possible design mobile application that the researchers will develop. In the article that was made by Bhatt in 2019 [6] entitled *"9 Key Factors Affecting the Success of Mobile App Development"* most of the features that the customer asks for were:

- the validity of the data that are produced in the mobile application
- the user experience that establishes if the mobile application is user-friendly
- the features of the mobile app or the perks
- the complexity of the mobile application that dictates if it needed a lot of steps just to use the application
- the speed of the application specifically if there are no delays in loading the pages in it.
- the offline capacity in QFD that pertains to the usability of the application without the use of the internet
- the availability of the application in different operating systems

- affordability

Customer importance rating (1: low, 5: high)	Relative Importance	Functional Requirements (How) / Customer Requirements - (What) ↓	User Interface ↑	Cost(Php) ↓	Security of the Application ↑	Operation System 0	Accuracy of the application ↑
		Desired direction of improvement (↑,0,↓) →					
5	20.00%	Data Validity		3	9	3	9
4	16.00%	User Experience	9		3	3	9
3	12.00%	Features	9	3	3	1	3
3	12.00%	Complexity	9	9	9	3	3
2	8.00%	Speed of the Application	3	9	3	3	1
2	8.00%	Offline Capacity		3	3	1	3
3	12.00%	Availability of the Application				9	
3	12.00%	Affordability		9	9	1	
25		Technical importance score	96	102	132	77	107
		Importance %	19%	20%	26%	15%	21%
		Priorities rank	4	3	1	5	2

Table 1. Quality Function Deployment

5.2 Graphical Results

In the results, we have identified that having the ability to check their connectivity and set the frequency of the summarization, whether daily, weekly, or even monthly is a must feature related to user experience. This makes it easy for the students to choose and to see their internet connectivity activities. Another good to have feature related to data validity is the ability to send the summarized data to their professors, as the data that they will be sending should be accurate.

Figure 2. Summary of survey results

The application is designed based on the system requirements that the researchers have gathered through a survey which displays what relevant data must be shown to the user. Based upon the survey results that has been gathered, 85.6% of the population have shown interest to knowing the status of their internet connection. The students

can use this application as a proof to show to their professors that they have lost or had an unstable internet connection and must be reconsidered. It is shown in the results that 10.8% of the students were never allowed reconsideration, 31.7% were seldom given reconsideration and 21% were given "fair" reconsideration depending on the activity.

One important aspect considered is the monitoring of the periodical reporting of the internet stability of the application, including its frequency. Whenever the user is using the internet, the connection stability of their ISP is recorded even the daily consumption of their internet bandwidth through downloads, uploads, and streaming. Even though that there is an even split between the daily (17.4%), weekly (22.2%) and monthly (21%) reports, there is a considerable amount of students who only want to send a report to their professor when they only lose internet connection (39.5%). Many students want to monitor the state of their internet connection (88.6%) and notify them if they lose it (94.6%).

4.1 Proposed Design of the Mobile App

Figure 3. User Set-Up Profile
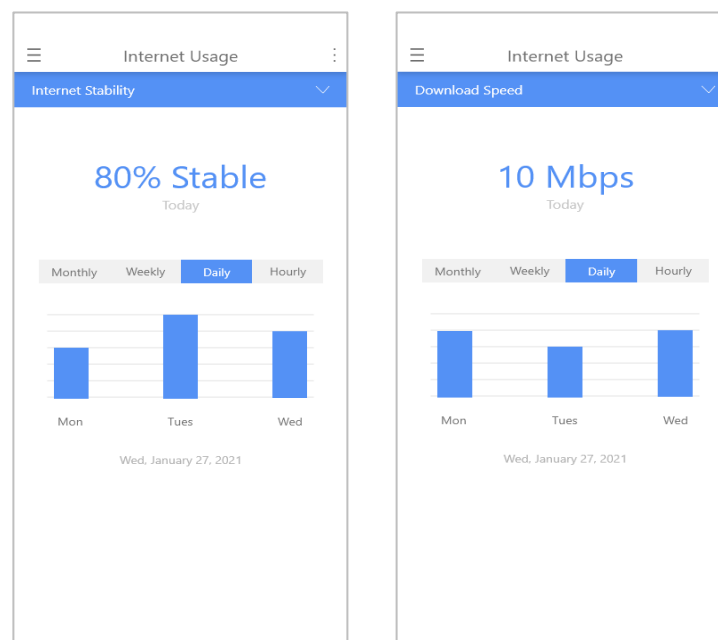

Figure 4. App Settings

Figure 5. Internet Stability and Download Speed dashboards

The proposed design for the mobile application can be seen through Figures 3-5. Figure 3 is the User Set-up Profile, where the user can change their profile picture, and edit their first name, last name, gender, location, email address and password. Figure 4 shows the App Settings, where the settings of the application show the profile of the user, and the other submenus help the user customize their experience.

Figure 5 shows the dashboards to display the trend of data of the internet stability and speed. There is a submenu that allows the user to see the data between internet stability, upload speed and download speed. On the visuals, it shows the date, trends and the recording frequency of the data that is user-adjustable to suit their needs.

6. Conclusion

The continuity of learning through online delivery during the pandemic still faces several challenges among the students; one of which is having weak internet connectivity that causes the students to miss their class or fail to submit requirements. Through the collated results of survey questionnaires, the proponents of this study had performed data analyzation that led to graphical representation consisting of data percentage and frequencies.

The results show that majority of the respondents experience weak internet connectivity. Despite connecting to the top service internet provider, there are still instances of losing internet connection 1 to 3 times caused by the low signal acquisition from their locales. Another factor of weak internet connectivity was the number of devices or individuals connected to the internet, wherein internet connectivity weakens or slows down were due to the bandwidth max consumption. The proponents of this study had synthesized that they will build a mobile application for the user to monitor their internet stability and bandwidth consumption whenever they are connected to the internet.

The opportunities that the study could offer are applicable not only to its target population but also to the mobile developers, internet service providers, and educational institution. These are as follows:

1. The study would be providing an additive information to internet service providers about the performance of the service that their customers are receiving based on their locale.
2. The collated results of the study will aid mobile developers if they aim to modify the proposed application to be developed.
3. The study will provide educational institutions sufficient proof in giving out consideration to the students in accepting work pass the deadline due to internet complications.
4. The developed application will be able to send a notification of internet disconnection to the user, thus they could also export the dashboard as a valid proof of their weak internet connectivity on that period.
5. The application that will be developed will help the user to monitor their internet speed, and their consumption either chronological (time period) or categorical (downloads, uploads, and stream).

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Biographies

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Grace Lorraine Intal is a full-time faculty member in Mapua University. She is teaching Information Systems core courses in the School of Information Technology and Information Systems course in the School of Industrial Engineering. She obtained a BS degree in Management and Industrial Engineering from Mapua University, Master in Business Administration from Pamantasan ng Lungsod ng Maynila and Master in Information Systems from Asia Pacific College respectively. At present, she is pursuing a Doctorate degree in Information Technology at the University of the Cordilleras. She is also an independent Management Consultant.

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